1.6 Challenges and Data Gaps

Outdoor Air Quality and Acid Deposition

In general, some very good indicators of outdoor air quality exist. The national air monitoring network for the six criteria air pollutants is extensive; however, there are far more monitors in urban areas than in rural areas. Monitoring in urban areas helps to characterize population exposures, because population tends to be concentrated in urban areas. More rural monitoring might help scientists assess transport and ecological effects, although EPA uses additional tools and techniques (e.g., models and spatial analyses) to augment limited monitoring in some areas and to better characterize pressures on ecological condition. EPA is currently conducting a national assessment of the existing ambient monitoring networks and is analyzing, among other issues, the need for and appropriateness of each of the nation's urban monitors.

Many major metropolitan areas monitor air quality for the presence of selected air toxics. However, there is no national monitoring network with standard data collection guidance for air toxics; therefore, numerous air toxics are not being measured. National assessments of levels of air toxics would benefit from a more extensive ambient monitoring network for toxics. EPA is currently working with state and local partners to design and deploy such a network.

Questions still exist about how indicators of concentrations and emissions relate to exposure and human health effects. The use of one approach to determining how various air pollution levels affect health would be to use established and quantified effects and surrogates for air pollution health impacts from epidemiology studies, such as asthma hospitalizations and childhood school absences. Research needs to be conducted that will develop these health endpoints into useful indicators.

As highlighted in Chapter 4, Human Health, for most health outcomes other than mortality, no national systems for data collection currently exist. With regard to criteria air pollutants, it would be useful to track asthma and chronic respiratory diseases, cardiovascular diseases, and adverse birth outcomes. For air pollutants in general, including air toxics and indoor pollutants, the list can also include neurological diseases, developmental disabilities, reproductive disorders, and endocrine/metabolic disorders.

As described in Chapter 5, Ecological Condition, there are large gaps in our ability to report on the condition of ecological systems and linkages between indicators of atmospheric stressors and specific ecological effects. There is a need for improved monitoring information for deposition and concentrations of both criteria and toxic air pollutants to ecosystems. Data on exposure of high-elevation forests and their watersheds to ozone and acid deposition are especially sparse, relative to data on lower elevations. And exposure patterns are likely to be significantly different at higher elevations because of higher acid deposition rates due to higher rainfall and fog, and less diurnal variation in ozone concentrations due to less nighttime scavenging (NAPAP, 1991). Furthermore, despite considerable progress, there is still no index of ozone exposure that relates optimally to plant response (EPA, NCEA, July 1996). Although mercury monitoring has begun as part of the National Atmospheric Deposition Program, the availability of data is inadequate to assess national trends (EPA, OAQPS, ORD, December 1997). There are inadequate data on indicators of actual UV exposures of ecosystems of all types.

Indoor Air Quality

While environmental indicators have been developed for some aspects of indoor air, significant gaps exist in our knowledge about the conditions inside the nation's buildings. For schools and residences, a large amount of information on IAQ is available, but it is composed primarily of case studies and, at best, small regional studies. Exposure studies on a national scale would help better characterize IAQ of schools and residential indoor environments, including multiple family residences. Ideally, these studies would collect exposure data on air toxics and PM in these indoor environments, and data for the various biological contaminants found in indoor air.

Stratospheric Ozone

In general, high quality data exists with which to predict the human health effects of increased ultraviolet exposure resulting from depletion of the stratospheric ozone. These include robust satellite data on stratospheric ozone concentrations and UV-B levels, comprehensive and well documented incidence and mortality rates for cutaneous melanoma, and well characterized action spectra for skin cancers and cataracts. However, there are areas where additional data would be useful. First, no national system exists that collects incidence data for squamous cell carcinoma and basal cell carcinoma, the non-melanoma skin-cancers caused by increased UV-B exposure. Thus, our incidence estimates are modeled using data from a nation-wide survey of non-melanoma skin cancer incidence and mortality, and may not represent the most current non-melanoma skin cancer rates. Second, there is a lack of adequate ground level UV monitoring with which to compare the satellite data. Satellites cannot directly measure ground level UV, and are sensitive to pollution. Therefore, while satellite data compare fairly well to ground level UV measurements in clean locations, this is not the case in polluted areas. Additional UV monitoring in cities is crucial to support future epidemiological research on the human health effects of UV-B exposure. Third, increased UV-B levels have been associated with other human and non-human endpoints including immune suppression and effects on aquatic ecosystems and agricultural crops. However, additional research on these topics is necessary before these effects can be modelled or quantified. Finally, the future behavior of the ozone layer will be affected by changing atmospheric abundances of various atmospheric gases. It remains unclear how these changes will affect the predicted recovery of the ozone layer. Additional research on the interaction between climate and stratospheric ozone could provide more accurate predictions of ozone recovery and the human health effects resulting from ozone depletion.